Oxford Cambridge and RSA

# OCR-set Assignment

# Sample Assessment Material

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Engineering

Unit F135: Mechanical product design

Scenario Title: Toaster redesign

Valid for assessment from September 20XX to 20XX.
For use by students beginning the qualification in September 20XX.

This is a sample OCR-set assignment which should only be used for practice**.**

This assignment **must not** be used for live assessment of students.

The live assignments will be available on our secure website, 'Teach Cambridge'.

**The OCR administrative codes linked to this unit are:**

- unit entry code F135
- certification code H127

**The regulated qualification number linked to this unit is:**

F/651/0638

**Duration**

About 18 hours of supervised time (GLH)
(work that **must** be completed under teacher supervised conditions)

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# Information and instructions for Teachers

## Using this assignment

This assignment provides a scenario and set of related tasks that reflect how mechanical design engineers might analyse an existing product and suggest changes to meet the needs of a design brief.

You can give this to students on or after 1 June 20XX to help them understand it before they start using it for assessment. The dates for which students can use it for assessment are shown on the front cover.

The assignment:

- Is written so that students have the opportunity to meet the requirements of all assessment criteria for the unit.
- Will tell students if their evidence must be in a specific format. If the task does not specify a format, students can choose the format to use.
- **Must** be completed under teacher supervision. Any unsupervised time allowed will be explained in the assessment guidance.
- We have estimated that this assignment will take about 18 hours of supervised time to complete.
  Students should need approximately:
  - 6 hours to complete Task 1
  - 12 hours to complete Task 2

You **must**:

- Use an OCR-set assignment for summative assessment of students.
- Familiarise yourself with the assessment criteria and assessment guidance for the tasks. These are given at the end of each student task. They are also with the unit content in **Section 5** of the Specification.
  Assessment guidance is only given where additional information is needed. There might not be assessment guidance for each criterion.
- Make sure students understand that the assessment criteria and assessment guidance tell them in detail what they need to do in each task.
- Read and understand **all** the rules and guidance in **Section 7** of the Specification **before** your students start the set assignments.
- Make sure that your students complete the tasks and that you assess the task fully in line with the rules and guidance in **Section 7** of the Specification.
- Make students aware of all relevant health and safety considerations before starting any practical work.

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- Make sure that students are appropriately supervised during any practical work and are working safely.
- Intervene during practical work if necessary to ensure students' safety. In such instances, staff should assist the student to ensure their safety and so that they can continue with the subsequent assessment tasks, but they cannot be credited for the criteria directly addressing the practical skills where they have had to be helped unless the assessment guidance states otherwise.
- Give your students the Engineering **Student guide to NEA assignments before** they start the assignments.

You **must not**:

- Use live OCR-set assignments for practice or formative assessment. This sample assessment material **can** be used for practice or formative assessment.
- Use this sample assessment material for live assessment of students.
- Allow group work for **any** task in this assignment.
- Change any part of the OCR-set assignments or assessment criteria.

## Information for delivering tasks

| Task | Requirements |
|---|---|
| All | • There is no requirement for any electrical components to be included in the redesign work. |
| Task 1 | • The product does not need to be identical to the example pictured in the scenario.<br>• Any product(s) purchased for the purpose of this task must be able to be disassembled.<br>• There is no requirement for any permanent fixings to be taken apart as part of any disassembly. |

**Pages 1-4** are for teachers only. Please do **not** give **Pages 1-4** to your students.

You can give **any** or **all** of the pages **that follow** to your students.

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# Tasks for students and assessment criteria

## Unit F135: Mechanical Product Design

## Scenario Title: Toaster redesign

Valid for assessment from September 20XX to 20XX.

For use by students beginning the qualification in September 20XX.

## Scenario

You work for a product design company as a mechanical product designer. A client has asked you to redesign an existing product.

The product is a budget two-slice toaster.  An example of a two-slice toaster is shown below**.** The two-slice toaster that you are using may look slightly different

to this one.


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**Note you do not need to include any of the electrical components from the two-slice toaster in your redesign work.**

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# Task 1

## Product Analysis

Topic Area 1 is assessed in this task.

Before you can consider the redesign of a product you must have a thorough understanding of exactly what the product does, how it works, and the materials and processes used in its manufacture.

The client has provided an example of the product they want redesigned. You will investigate the function of the product and its operating principles, including the safe disassembly of the product into its main components.

**The task is:**

To complete a product analysis of a toaster including:

- a record of the disassembly process so that a third party could reassemble the product.
- analyse **two** different non-standard components and use your knowledge of engineering materials and processes to:
  - identify the materials they are made from, and the processes used to manufacture them.
  - identify **two** design features of these components that make the manufacture or assembly easier.

Your evidence **must** include:

- A written summary of the product function and operating principles
- A record of the disassembly of the product including notes with sketches and/or photographs
- Written material about the analysis of the two different non-standard components selected

**Use the assessment criteria below to tell you what you need to do in more detail**

| Pass | Merit | Distinction |
|---|---|---|
| **P1: Describe** the function(s) of the product. (PO2) | **M1: Explain** how the operating principles enable the product to function. (PO2) | |
| **P2:** Safely **disassemble** an engineered product into its main components. (PO4) | **M2: Produce** information about how to methodically disassemble the product. (PO4) | **D1: Produce** clear guidance to allow reassembly of the product by a third party. (PO4) |
| **P3: Identify** the materials used to make **two** different non- | | **D2: Analyse** the materials and processes used for **two** non- |

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| | | |
|---|---|---|
| standard components (PO4) (Identification through **doing** tests) | | standard components, including how you were able to identify them. (PO3) |
| **P4:** Identify **two DFMA related** design features from the components in **P3**. (PO2) | | |
| **P5: Identify** suitable manufacturing processes used to make **two** different non-standard components. (PO2) | | |

**Assessment Guidance**

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

| **Assessment Criteria** | **Assessment guidance** |
|---|---|
| P2 | • Permanent fixings do not need to be taken apart as part of any disassembly. You also do not need to disassemble any of the electrical or electronic components.<br>• Guidance on the main components will be given in the advice section of each assignment.<br>• Students must be able to perform the task safely to achieve this criterion. Staff must intervene if safe working practices are not being followed but where this happens the criteria cannot be awarded as achieved. |
| P3 | • The non-standard components selected need to be made using different materials and different processes |
| P4 | |
| P5 | |
| D2 | • Students must consider the design requirements. |

**Advice:**

- You should read any user documentation provided by the product manufacturer.
- Any operation of the product should be carried out safely.
- The main components in a toaster vary depending on the model. For example, the main components may include: the outer casing, controls (e.g.


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a lever, button and switch), crumb tray, top and base plates, toast shelf / rack, insulation / radiation shields, and the inner housing assembly.

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# Task 2

## Product redesign

Topic Area 2 is assessed in this task.

The client would like you to develop a design proposal for an improved version of their toaster.

They have a developed a design brief based on their own market research.

The requirements for the redesigned toaster are that it **must**:

- have capacity for up to four slices of bread
- have a switch to select one, two, three or four slice operation
- be easy to maintain and repair.

The client has asked that you concentrate on the overall design concept. They would like to see:

- the research you have done into existing products
- redesign options you have considered, and
- a final design proposal.

Details of electrical circuits or internal mechanisms are **not** required.

### The task is:

Produce a design proposal that satisfies the client's design brief, using your product analysis and research and following the stages of the design process.

You will need to:

- Create **three** different design ideas for each requirement from the client brief and communicate these using annotated freehand sketching and notes.
- Develop **one** idea into a final design presentation drawing and proposal.

Your evidence **must** include:

- A written summary of your research into similar products
- Notes, sketches and drawings detailing **three** design ideas and your final design drawing and proposal
- Any written material needed to support your work (e.g. analysing options, justifying choices, etc…).

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**Use the assessment criteria below to tell you what you need to do in more detail.**

| Pass | Merit | Distinction |
|---|---|---|
| **P6: Summarise** research into similar existing products. (PO4) | | |
| **P7: Create three** different design ideas for each of the requirements of the design brief, using annotated freehand sketches. (PO4) | **M3: Analyse** how effectively the different design ideas fulfil the requirements of the design brief. (PO3) | **D3: Justify** the selection of one idea for each requirement for further development. (PO3) |
| **P8: Draw** detailed annotated freehand sketches to communicate the development of a final design that meets the requirements of the design brief. (PO4) | | |
| **P9: Draw** a 3D presentation line drawing of the final design from **P8**. (PO4) | **M4: Use** rendering, colour, appropriate labelling and annotation to enhance the 3D presentation drawing of the final design (**P9**). (PO4) – rendering by hand | |
| **P10: Select two** different, appropriate materials for use in the manufacture of the product. (PO2) | **M5: Justify** the selection of **two** materials in terms of their qualities, for use in the manufacture of the product. (PO3) | |
| **P11: Select two** different, appropriate processes for the manufacture of the product. (PO2) | | **D4: Justify** the selection of the **two** processes in terms of their characteristics, for use in the manufacture of the product. (PO3) |
| | **M6: Analyse** how effectively the final design fulfils the requirements of the design brief. (PO3) | **D5: Recommend** further appropriate improvements to the final design. (PO3) |

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## Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

| Assessment Criteria | Assessment guidance |
|---|---|
| P7 | • The emphasis here is on creating different design ideas rather than drawing skills although drawings need to be of sufficient quality to communicate the ideas effectively.<br>• Students can produce three product designs, each of which has different ideas for each of the requirements, or they can produce separate ideas for each of the requirements (for example, three sets of three thumbnails per requirement)<br>• The different design ideas should have different geometric forms |
| M3 | |
| P8 | • The emphasis here is on the quality of the drawings and communication of the final design idea as well as the suitability of the final design. |
| P9 | • The emphasis here is on drawing skills and communication skills rather than the quality of the final design or its suitability to meet the requirements from the brief. |
| M4 | |
| P10 | • Students must include notes to indicate the selection and use of **two** different materials. |
| P11 | • Students must include notes to indicate the selection and use of **two** different processes. |
| M5 | • The qualities refers to those listed in the unit under section 2.1.3 Material and process selection |
| D4 | • The characteristics refers to those listed in the unit under section 2.1.3 Material and process selection |

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# NEA Command Words

The table below shows the command words that may be used in the NEA assignments and/or assessment criteria.

| Command Word | Meaning |
|---|---|
| **Adapt** | • Change to make suitable for a new use or purpose |
| **Analyse** | • Separate or break down information into parts and identify their characteristics or elements<br>• Explain the pros and cons of a topic or argument and make reasoned comments<br>• Explain the impacts of actions using a logical chain of reasoning |
| **Assess** | • Offer a reasoned judgement of the standard or quality of situations or skills. The reasoned judgement is informed by relevant facts |
| **Calculate** | • Get a numerical answer, showing how it has been worked out |
| **Classify** | • Arrange in categories according to shared qualities or characteristics |
| **Compare** | • Give an account of the similarities and differences between two or more items, situations or actions |
| **Conclude** | • Judge or decide something |
| **Describe** | • Give an account that includes all the relevant characteristics, qualities, or events |
| **Discuss** (how/whether/etc) | • Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement |
| **Evaluate** | • Make a reasoned qualitative judgement considering different factors and using available knowledge/experience |
| **Examine** | • To look at, inspect, or scrutinise carefully, or in detail |
| **Explain** | • Give reasons for and/or causes of something<br>• Make something clear by describing and/or giving information |
| **Interpret** | • Translate information into recognisable form<br>• Convey one's understanding to others, e.g. in a performance |
| **Investigate** | • Inquire into (a situation or problem) |
| **Justify** | • Give valid reasons for offering an opinion or reaching a conclusion |
| **Research** | • Do detailed study in order to discover |

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| | |
|---|---|
| | (new) information or reach a (new) understanding |
| **Summarise** | • Express the most important facts or ideas about something in a short and clear form |

We might also use other command words but these will be:

- commonly used words whose meaning will be made clear from the context in which they are used (e.g. create, improve, plan)
- subject specific words drawn from the unit content.

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